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ABSTRACT

Through the years teachers have developed a systematic approach to teaching logic, order, and structure. This approach has put to use the capabilities of only the left side of the brain, neglecting the right-brain activities of visual literacy and visual clustering. To help students organize information efficiently, teachers should provide activities, such as clustering, that allow their students to use both sides of their brain. To teach how to cluster information, a teacher should draw a circle in the center of the chalkboard, and then print, in capital letters, the main idea of a book or short story the students are currently reading in the circle, with the other ideas that relate to the main idea on lines branching out from the circle. The advantages of using the circle and lines are that (1) the key concept is more clearly defined, (2) more important ideas will be close to the center, (3) the connection between the key concept and related ideas will be clearer, (4) this structure allows for adding new information easily, and (5) review and recall should be more effective and rapid. Therefore, by using clustering, the student can process information through both the analytic left side of the brain and the creative right side of the brain. The result is that the student has a greater likelihood of recalling the information. (EL)

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USING BOTH SIDES OF THE BRAIN IN TEACHING

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ABSTRACT

The brain is split into left and right hemispheres. Each hemisphere has distinct functions. The left side of the brain specializes in language skills, such as speech, writing, mathematics, and reasoning. The right side of the brain specializes in powers of intuition, spatial perception, and creativity.

Research findings indicate that students perform better when teachers use visual-verbal activities to present information. Students then use both sides of their brains.

Clustering presents a method for putting information in a visual-verbal framework. The students receive an overview of the information in greater detail and comprehension than they would receive using traditional linear outlining methods.

USING BOTH SIDES OF THE BRAIN IN TEACHING

1.0 INTRODUCTION

While driving down Interstate 40, a person may think only of his destination. He does not think of the process that he is going through to reach his destination or goal. He does not think about the actual process of steering the car around the curves or pushing down the gas pedal to accelerate while driving to his destination. The same situation is true in learning. Educators are in the drivers' seats. They do not think about how students are to reach certain goals: finishing assignments, passing tests, and getting diplomas. Educators pay little attention to the learning process their students go through to reach these goals. The purpose of this report is to discuss the learning process that takes place when visual-verbal teaching methods are used. If teachers understand the importance of using visual-verbal teaching methods, they can gear their assignments to make the most of their students' visual-verbal capabilities. Then the students can absorb, retain, and use the information more readily.

First of all, teachers must understand the functions of various parts of the brain. With the knowledge of how

the brain functions, teachers will better understand the overall process of learning. They will be in a better position to understand how visual-verbal methods of teaching make the best use of the brain's functions.

2.0 DEFINITIONS

2.1 THE BRAIN

The brain, which weighs only three pounds, contains all the equipment a person uses to learn any material. The brain has three major functions: (1) to gather data, (2) to evaluate and sort data, and (3) to file data (Haines, 16-17).

The brain performs these three functions by using the hindbrain, the midbrain, and the forebrain. The medulla oblongata, pons, and cerebellum compose the hindbrain. When the spinal cord enters the skull, it thickens into the medulla oblongata. Messages from the brain to the body cross in the medulla. Messages from the right side of the brain go to the left side of the body. Messages from the left side of the brain go to the right side of the body.

Above the medulla is a group of nerve fibers called pons. The pons connects the medulla and the two sections of the cerebellum with the remainder of the brain. The cerebellum coordinates complex motions, such as bouncing a basketball (Haines, 18-19).

The midbrain contains a group of nerve cells called the reticular formation. This group of nerves screens

messages received from the body. The reticular controls consciousness and memory recall (Haines, 19).

Above the midbrain is the forebrain. In the forebrain is a nerve center called the hypothalamus that controls temperature, sleeping and eating. Next to the hypothalamus is the pituitary gland which helps control growth and memory storage. Located near the pituitary gland is the hippocampus that stores and retrieves memories (Haines, 21).

Eighty-five percent of the brain is comprised of the neocortex which is responsible for language, complex thinking, and reasoning. The neocortex covers the outer layer of the largest part of the brain, the cerebrum. Deep ridges called convolutions surround the cerebrum. The cerebrum is divided into two hemispheres: the left hemisphere and the right hemisphere. These two hemispheres are connected by a large group of nerve fibers called the corpus callosum. This connection is responsible for the brain being split into the two hemispheres (Haines, 22).

The role of each side of the brain has been established (See Figure 1). The left side of the brain specializes in the following aspects:

1. verbal,
2. analytical,
3. symbolic,
4. abstract
5. temporal,
6. rational,

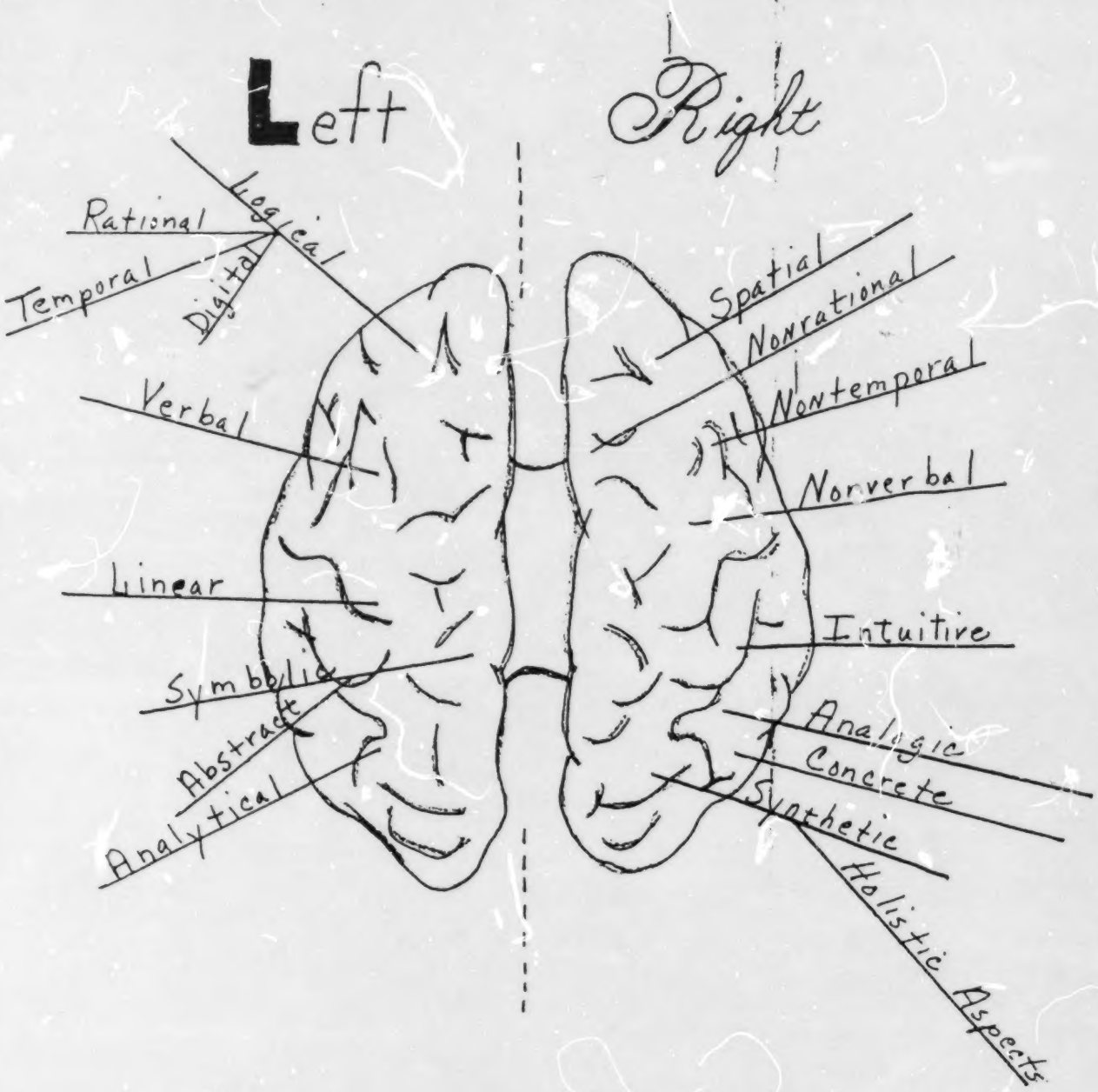


Figure 1. FUNCTIONS OF THE HUMAN BRAIN
Functions of the left and right hemispheres of the brain are shown.

7. digital,

8. logical, and

9. linear.

The right side of the brain specializes in the following aspects:

1. non-verbal,

2. synthetic,

3. concrete,

4. analogic,

5. nontemporal,

6. nonrational,

7. intuitive, and

8. holistic aspects.

2.2 CLUSTERING

Too often, teachers concentrate only on helping students use the left sides of their brains. When teachers teach reading, mathematics, composition, and language, they often do not use any visual stimuli and ignore the right sides of their students' brains. Teachers should be equally concerned with helping students use the creative processes of the right side of the brain. To help students organize information efficiently, teachers must provide activities, such as clustering, that allow their students to use both sides of their brains.

To teach students how to cluster information, a teacher should first draw a circle in the center of the chalkboard.

In that circle, the teacher should print in capital letters the main idea of a book or short story that the students are currently reading. The teacher should put the other ideas that relate to the main idea on lines branching out from the circle (See Figure 2). The cluster, or pattern, that emerges from the use of the circle and lines produces a comprehensive feed-back for the person processing the information.

Students find clustering easy because clustering is related to the brain's natural ability to use both hemispheres. In the past, students used the 1,2,3 or outline order to process information. Tony Buzan, a British educational psychologist, explains that the brain does not allow people to think in a linear, or list-like manner, as scientists earlier believed (Buzan, 84). Information should be structured in clusters instead of in a straight-line list, as traditionally done. Thought processes can then proceed in a natural flow.

By using clustering, the student can process information through both the analytic left side of the brain and the creative right side of the brain. The result is that the student has an overview of the information in greater detail, and has a greater likelihood of recall of the information. The student has imposed meaning on the information through structure.

Traditionally, students had to add or subtract information. Now, by using clustering one idea is freely associated with others in a visual pattern.

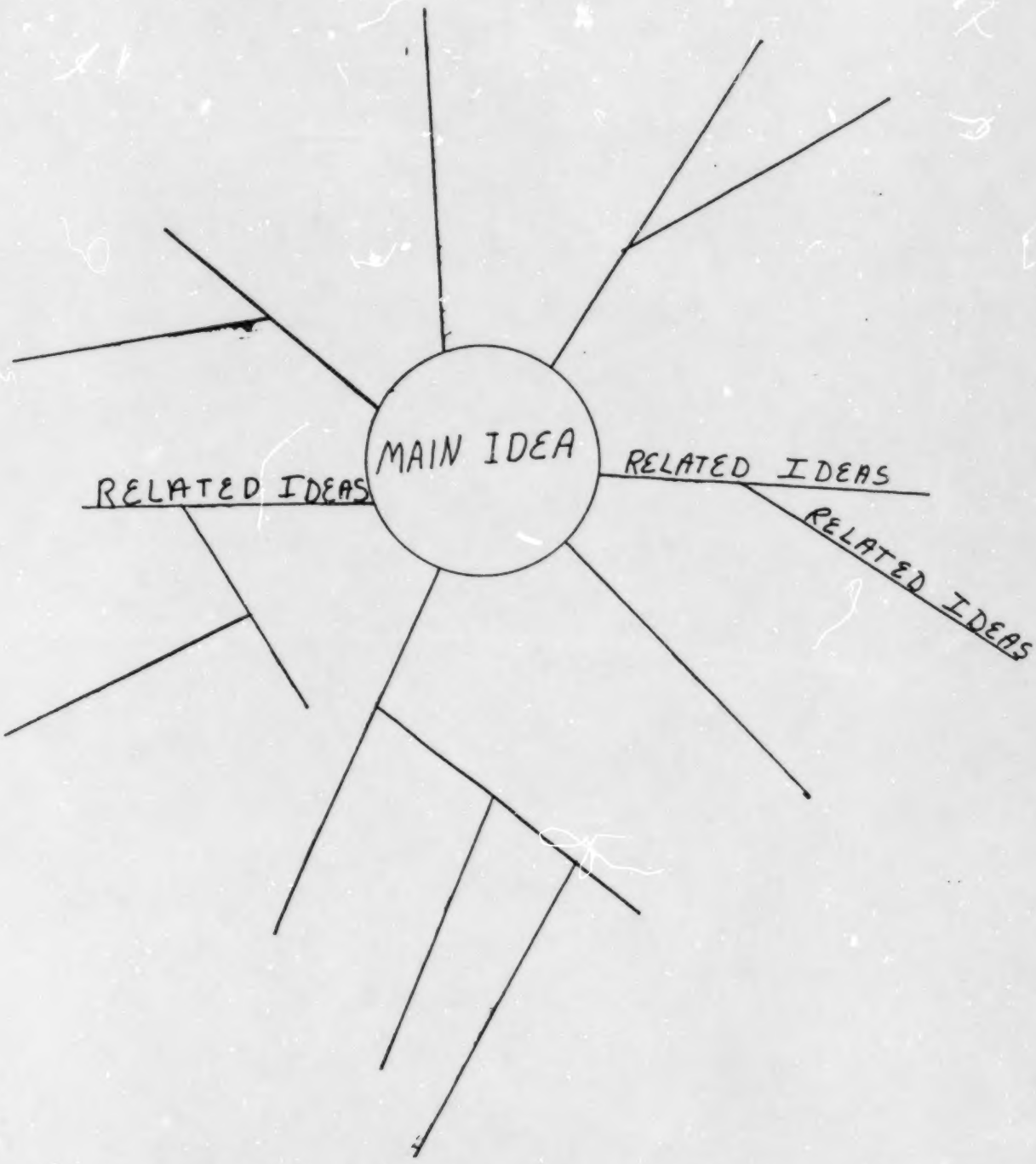


Figure 2. A CLUSTERING PATTERN

Related ideas are printed in capital letters on the lines branching out from the main idea.

To foster student creativity that occurs in the right side of the brain, the student's brain should be left free to recall every detail possible about the main idea in the material he has been reading. This creativity in processing information does have structure because the student is using the left side of his brain to connect the lines to join details to the main idea.

3.0 EXPERIMENTS

In order to help students use visual-verbal learning techniques more effectively, teachers must understand the process by which visual memory works. Everyone has a double brain: the left and right hemispheres. Visual memory is located in the right hemisphere.

Scientists have determined by studying persons who have lost the use of parts of their brains that each hemisphere of the brain performs different functions in a person's behavior. The left side of the brain specializes in language skills, such as speech, writing, mathematics, and reasoning. The right side of the brain specializes in powers of intuition, spatial perception, and creativity.

The discovery of the interaction of the brain's hemispheres came in 1864 when Hughlings Jackson determined that the right brain has certain capacities of visual perception which the left brain does not have. In the 1960s, Roger W. Sperry and his colleagues, Ronald Myers and Michael Gazzaniga, learned through investigation how visual information is transmitted and stored in the brain (Bailey, 81).

3.1 CATS' EYES AND BRAINS

Roger W. Sperry and his colleagues, Myers and Gazzariga, learned how visual information is transmitted and stored in the brain by studying the brains of cats. They found that (as with human beings) cats have optic nerves that stem from both retinas, but these optic nerves divide before reaching the brain. The nerves from the right side of both retinas go to the right brain. The nerves from the left side of both retinas go to the left brain. Therefore, the right brain sees the left part of a picture, and the left brain sees the right part of a picture. With the help of the corpus callosum interconnection, the two images mentally combine to give cats a single view.

As an experiment, Myers surgically rearranged a cat's optic nerves so the nerves of the left eye went only to the left brain, and the nerves of the right eye went only to the right brain. The cat could no longer use both eyes to discriminate between objects. The cat now had a left brain and left eye that functioned independently of its right brain and right eye. Each eye had to perceive the objects separately from the other eye. Each side of the brain had to record the object separately from the other side of the brain. The scientists concluded that each side of the brain can operate independently of the other side (Bailey, 82).

3.2 HUMANS' EYES AND BRAINS

Continuing their research at the California Institute of Technology in 1961, Roger Sperry and Michael Gazzaniga saw a human whose brain had been bisected. The patient was a 48-year-old war veteran whose brain had been damaged by bomb fragments. This injury caused him to have severe convulsive seizures. Surgeons Joseph Bogen and Philip Vogel of the White Memorial Medical Center in Los Angeles cut the corpus callosum that connected the man's left and right brain hemispheres. After recovering from the surgery, the man had no more seizures (Sperry, 30).

However, Sperry and Gazzaniga found the patient could no longer transfer information from one hemisphere of the brain to the other hemisphere. Before they showed him a picture, the man was told to look straight ahead. When he was shown a picture placed to the left side of his retina, only the right side of the retina saw the picture. The image was registered only on the right side of his brain. Consequently, when he was shown a picture placed to the right side of his retina, only the left side of the retina saw the image. The image was registered only on the left side of his brain (Bailey, 84).

3.3 BLOOD FLOW

Recent research supports Sperry and Gazzaniga's theories about the hemispheres of the brain. The up-dated research shows how blood flows through the brain. David Ingvar used

radioactive isotopes injected into a patient's blood stream and monitored the blood as it flowed through the brain. Studies were made of cerebral blood flow during mental and physical activities. The results showed that the flow through the left hemisphere was greater in volume when the subject performed verbal tasks. The flow through the right hemisphere was greater in volume when visual tasks were performed (Springer, 93-94).

3.4 STROKE DAMAGE

Research concerning languages in different cultures supports the concept of left and right brain functions. The English language is a letter system. If an adult who knows English has a stroke that damages the left side of his or her brain, the capacity to write or read may be permanently lost. However, the Japanese have two systems for writing their language. The katakana is a letter system in which the symbols represent sounds. Kanji is a visual symbol system in which the symbols represent a concept rather than a sound. For example, one kanji symbol means east and another symbol means capital. When these two symbols are placed side by side, they represent the words east capital or Tokyo.

If a Japanese person who can read and write in both kanji and katakana has a stroke that damages the left side of the brain, he or she will not lose his ability to read and write in kanji. In the instance with the Japanese, the right side of the brain understands the visual system because the symbols

represent concepts. This study indicates that the visual sequencing of symbols (visual literacy) is a function of the right side of the brain (Debes, 3).

3.5 BRAIN DOMINANCE TESTS

Scientists use two tests to help determine which side of a person's brain is dominant. The first test is called the torque test. The person being tested draws a line of circles with each hand. If the subject draws all the circles counterclockwise, the left side of the brain is dominant. If the subject draws all the circles clockwise, the right side of the brain is dominant. However, if the subject draws some clockwise circles and some counterclockwise circles, then neither side of the brain is dominant (Haines, 41-42).

A second way scientists test for brain dominance is to check the way a person normally writes. The test involves observing whether the hand is held straight or hooked when the person writes. The person who holds his hand in a hooked manner is right-brain dominant. The person who holds his hand in the straight manner is left-brain dominant. Some people argue that the straight-hand position is more convenient for writing from left to right. However, scientists have found that even right-handed people who write in the Hebrew language (which runs from right to left) tend to use the straight-hand position. Dominance of the brain seems to determine the manner in which a person holds his or her writing instrument (Haines, 42).

Although these two tests alone are not conclusive, their reliability in helping to determine a person's brain dominance has been proved. Establishing which side of a student's brain is dominant is important so a teacher will understand why students may perform the same tasks differently. Students who do well in verbal tasks are left-brain dominant. Students who do well in visual-spatial tasks are right-brain dominant (Sinatra, 4). With this information, teachers can develop teaching methods that can make use of brain dominance so students can learn the material more efficiently.

4.0 EDUCATIONAL STUDIES

Betty Edwards reports that recent educational research indicates that the right hemisphere of the brain sees how things exist spatially and how the parts fit together to compose the whole (Edwards, 35-36).

4.1 ALBERT EINSTEIN

Albert Einstein is an example of a person who was right-brain dominant and was taught by a right-brain method. Although Albert Einstein proved to be a genius by his major accomplishments in life, he did not speak until age three. He remained primarily nonverbal until age eight. His parents became so frustrated that they looked for a different type of school for him. They chose a school using the methology of the Swiss educator, Pestalozzi. He believed that conceptual thinking is built on visual understanding. Pentalozzi also believed that visual understanding is the basis of all knowledge (Debes, 2).

After Einstein entered the Pestalozzi school, he began to improve intellectually. In later years, Einstein explained his accomplishments by saying he thought in an entirely visual way. "The really valuable thing is intuition," Einstein said. "A thought comes, and I may try to express it in words afterwards" (Bailey, 91).

If Einstein had never had the opportunity to be taught using visual right-brain methods, would he have reached the intellectual level that he did? That question has no valid answer. However, research concerning the Stanford-Binet intelligence test indicates that perhaps he would not have.

4.2 STANFORD-BINET INTELLIGENCE TEST

The Stanford-Binet intelligence test was created in 1927. A score of 100 was considered average for anyone taking the test. When Dr. Robert Thorndyke and his colleagues revalidated the test in 1977, they found the average Intelligence Quotient (IQ) of a child at $3\frac{1}{2}$ to be 110. They learned that the IQ continues to rise until $5\frac{1}{2}$. The the IQ begins a decline, leveling off when the child is $8\frac{1}{2}$ with an average score being 102 (Debes, 6).

What causes the IQ to elevate between ages two and five and then decline? Dr. Thorndyke did an item-by-item analysis of the scores of children who took the Stanford-Binet test. The IQ test items on which these children excelled were nonverbal or visual items. After the analysis, Dr. Thorndyke thought that he was justified in proposing the hypothesis

that there is a correlation between visual literacy and the amount of television viewed. He felt that television programs such as "Sesame Street" and "Electric Company" have made the difference in the test scores (Debes, 7).

The decline in children's test scores that begins at age 5½ may be due to the children's entrance into school. Their teachers have started instructing them using primarily verbal activities. To maintain an IQ score, both sides of the child's brain must be stimulated.

5.0 IMPLICATIONS

Through the years, teachers have developed a systematic approach to teaching logic, order, and structure. This approach has put to use the capabilities of only the left side of the brain. The right-brain activities of visual literacy and visual clustering have been neglected. Television has cultivated the right-brain hemispheres of children. In 1971, Michael Gazzaniga did further research which demonstrated that whichever hemisphere of the brain received earliest positive reinforcement becomes the dominant hemisphere (McLendon, 7).

Stanford-Binet Intelligence Quotient (IQ) test scores show the improvement of children's IQs between the ages of 3½ and 5½. The implication is that educators need to continue using visual presentations in their instruction so the children's IQs will continue to rise--not drop at age 5½ as the study of Dr. Thorrdyke shows (Debes, 5).

Sally Springer raises the questions: "Does the school program restricted to reading, writing, and arithmetic educate mainly one hemisphere and leave half of an individual's potential unschooled? Is the entire educational system biased against developing right hemisphere talents?" (Springer, 163). The implication is that teachers may not be able to teach students to solve the extremely complex problems with traditional methods of instruction. Carl Sagan feels that to solve complex problems a person must make use of both hemispheres of the brain. If the right hemisphere is able to organize patterns with emotional overtones, then the left hemisphere must provide the critical analysis to test the reality of these patterns (Sagan, 54).

Complex problems cannot be completely expressed in words. Robert Ornstein concludes that split- and whole-brain studies have led to a new concept about consciousness and intelligence. He is concerned that although all knowledge cannot be expressed words, educators use primarily written or spoken forms in their classroom presentations (Ornstein, 9). The implication is that teachers must develop a new method to present material that will help students use both sides of their brains.

Frank Hajcak, a psychologist, feels that the creative process of holistic thinking must be learned just as logical thinking. However, he thinks that educators do not apply creativity to all fields of study as much as they

should. He wants to see creativity used in science, business, sociology, and government. Hajcak wants creativity to become an integral part of education, not just a small portion (McLendon, 29).

6.0 CLUSTERING

6.1 INTRODUCTION

The two main methods of communication are speech and print. Because of the limitations of time and space, people are restricted to speaking and hearing only one word at a time. Speech is a linear process between people.

Print is even more linear then speech because the words are laid out on the page in a series of lines. Even when people take notes, they use a linear print form by making sentences or lists. Learning by speech and by print has long taken the linear left-brain form.

Research conducted in 1971 by Dimond and Beamont confirms that a student's learning potential is much greater when both hemispheres of the brain are used in a learning task (Sinatra, 6). The teacher must develop a visual strategy that will bring about cooperation between the left and right hemispheres of the brain. Haber's experiment in 1970 shows that if words and visual images are combined, a person's overall recall will improve immensely (Sinatra, 6). Visualization should not be considered just an aspect of the learning process. Both visual and verbal aspects should compliment each other (See Figure 3).

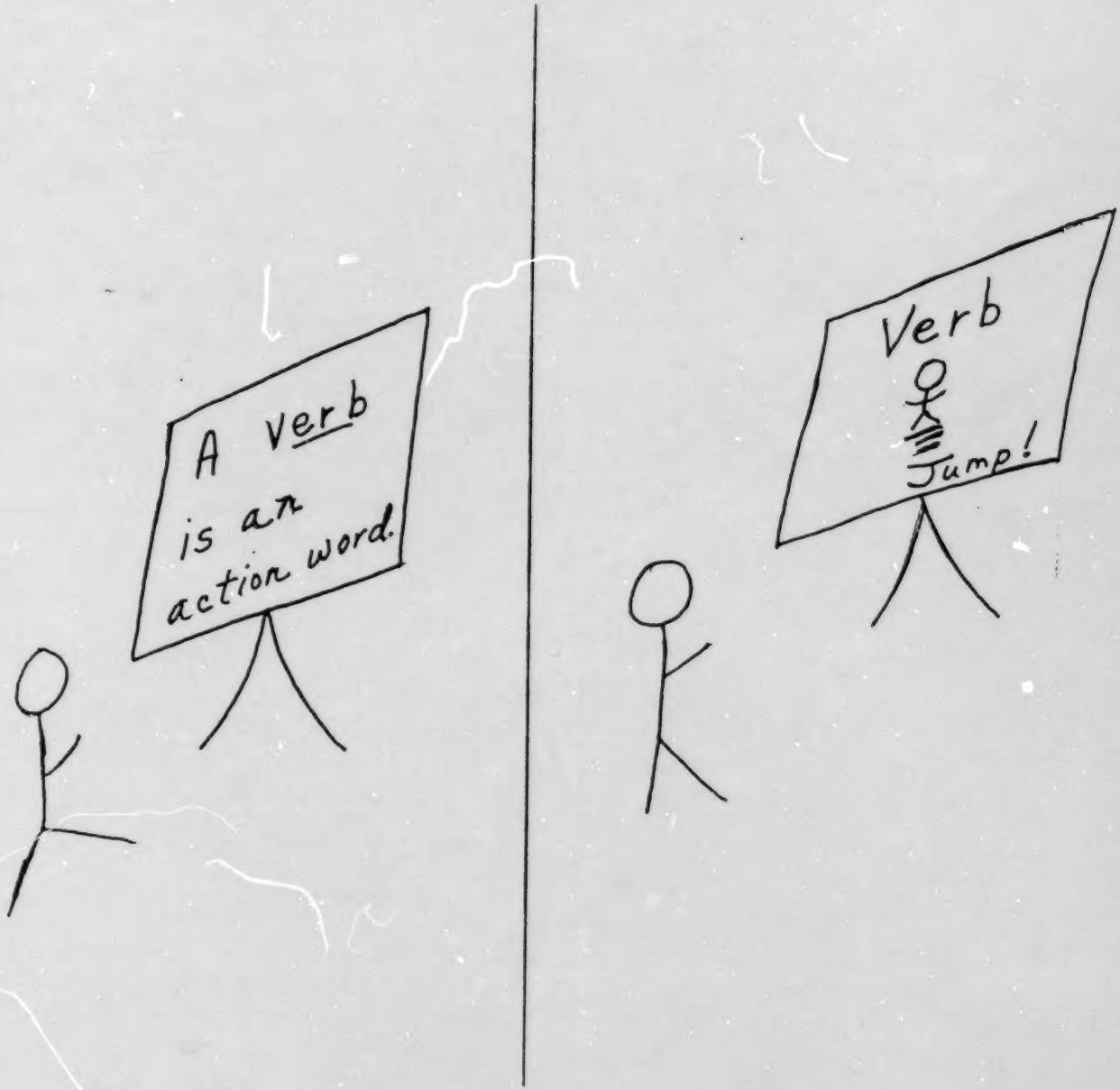


Figure 3. LEARNING SITUATIONS.
The teacher on the left is not using a visual image to help his or her students learn to identify a verb. The teacher on the right combines visual and verbal images to enable his or her students to use both sides of their brains to learn about the verb, jump.

Teachers should steer away from teaching the techniques of traditional linear outlining because this method involves only the use of the left hemisphere of the brain. Because the outline is a linear construction, the student does not use the right hemisphere of the brain.

6.2 DIRECTIONS

Because the brain primarily works with key concepts in an integrated manner, word relations should be structured in clusters instead of in vertical lines. A student should be taught to put the key idea in a circle in the center of a blank sheet of paper. In that circle, he or she should print in capital letters the main idea being considered. The student should put the other ideas that relate to the main idea on lines branching out from the circle.

The cluster that emerges from the use of the circle and lines has several advantages over the linear form of taking notes or outlining:

1. The key concept is more clearly defined.
2. More important ideas will be close to the center.
3. The connection between the key concept and related ideas will be clearer.
4. This form of structure allows for easily adding new information.
5. Because the student is using a structure, review and recall should be more effective and rapid (Buzan, 89).

The student should be encouraged to think about every aspect of the key idea. His or her mind may work faster than the pencil. This is good. The student should not worry about organization. The thoughts may take him or her on a tangent, depending on the type of assignment being done. Again, he or she should not be concerned. Corrections or changes can be made later. With the clustering approach, the mind can freely associate ideas with one another. The student is not stifled by having his ideas fit into a particular structure.

6.3 USES

6.3.1 Notetaking

Figure 12 shows a cluster created by a 14-year-old boy who was intelligent but messy and mentally disorganized. He had difficulty writing notes in a linear structure. However, after only five minutes of work, he created a neat and orderly cluster. By using the capabilities of both hemispheres of his brain, he created a visual-verbal cluster (Buzan, 92).

6.3.2 Brainstorming

Clustering can also be used to brainstorm before writing an essay or poem. For example, a group of students were shown Grant Wood's American Gothic.

Each student was asked to look at the picture and determine the main idea generated by the farm couple. Each student was to cluster the main idea and associated ideas.

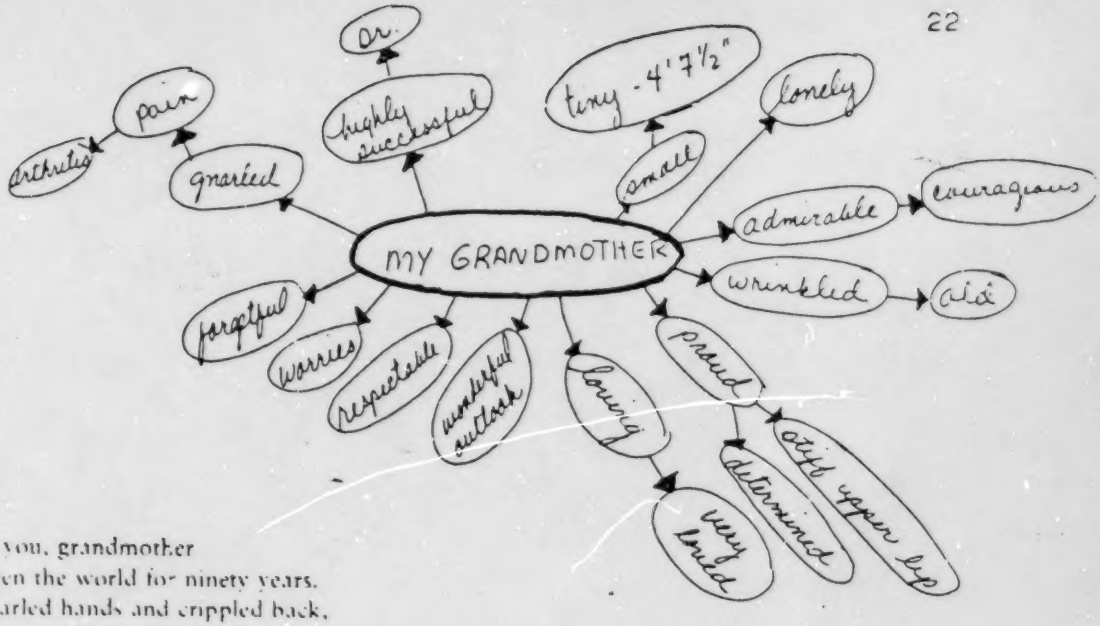
Then he or she was to write a brief essay based on the information clustered. Clustering can be used in a poetry writing assignment to help studens generate ideas for their poems. A teacher asked her students to write a poem to someone about whom they really cared. Figure 4 shows Marina Michaelian's cluster and resulting poem (Rico, 47-48).

6.3.3 Studying

When students study for final exams, clustering becomes a valuable tool. A student can get an overall view of the fundamentals learned in the course. For example, Buzan counseled with a student who failed a beginning-level economics course twice. The student's teacher thought he had serious thinking and learning problems. The teacher saw no evidence of any knowledge of economics.

7.0 CONCLUSION

Research findings show that the brain is split into left and right hemispheres. Each hemisphere has distinct functions. The left side of the brain specializes in language skills, such as speech, writing, mathematics, and reasoning. The right side of the brain specializes in powers of intuition, spatial perception, and creativity.



For You

This is a poem for you, grandmother
whose eyes have seen the world for ninety years.
This is for your gnarled hands and crippled back,
your failing memory and lasting confusion
that frustrates you again and again.
And this is for all the times you've hidden your pain
and laughed at yourself
when we were ugly and impatient with you.
And this is for your strength and courage
that keeps you going day on day,
letting you ignore the fact that you have lost all
the brilliance that once was yours,
letting you push aside the humiliation
your progressive dependence brings to you.
This is for your determination and stamina,
keeping you from placing blame and becoming embittered.
This is a poem for you,
my sweet, brave grandmother,
because you are all I hope I can ever be.

—Manna Michaelian

Figure 4. CLUSTER AND POEM

Drawing a cluster can generate ideas for a poem.

[Gabriele Lusser Rico. Writing the Natural Way (Los Angeles: J. P. Tarcher, Inc., 1983), pp. 47-48.]

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Research findings also indicate that students perform better when visual-verbal activities are used in presenting information to them because students then use both sides of their brains.

Traditionally, teachers have used primarily a verbal approach to present material. This approach uses the capabilities of only the left side of the brain. The right-brain functions have chiefly been neglected.

The teacher must develop a visual strategy to bring about cooperation between the left and right hemispheres of the brain. Clustering presents a method for putting information in a visual-verbal framework. Clustering can be used in notetaking, brainstorming, and studying for an exam. Key concepts can be freely associated with related ones. The result is an overview of the information in greater detail, comprehension, and greater likelihood of recall. Meaning has been imposed through a visual-verbal structure. Learning occurs more efficiently than through the traditional linear left-brain approach to instruction.

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